

VII. *On Sexual Dimorphism in Beetles of the family Rutelidæ.* By GILBERT J. ARROW, F.E.S.

[Read March 1st, 1899.]

THE recorded examples of Sexual Dimorphism among Coleoptera, other than those which consist in simple differences of development of various parts, such as the legs, antennæ, or mandibles, are at present very few. This is no doubt partly owing to the sexes having been regarded as distinct species through the attention of Coleopterists not having been sufficiently directed to the matter, and it is therefore well that observations, however incomplete, upon the occurrence of this interesting phenomenon in any group should be recorded in order to direct the attention of other workers to it, and thus at least diminish the serious complication of nomenclature which results from its neglect. This is of special importance in a great and heterogeneous assemblage such as the genus *Anomala*, whose swollen ranks already include considerably more than 500 described species of many different types, the merging of which into a single genus has proved extremely inconvenient to systematists.

A subdivision of the genus largely based upon the structure of the claws is at present in use, but facts which will be pointed out in this paper render this classification inadequate and even misleading. It has long been recognised that the degree of development of the claws of the anterior legs usually distinguishes the sexes in this group, and careful attention to this point will greatly increase the value of systematic work; but the occurrence of an entire difference of claw-structure between the sexes has only very recently been discovered. Sexual differences in coloration in species of *Anomala* have also been pointed out by Burmeister and Fairmaire, and the object of the present paper is to bring together the recorded instances of sexual dimorphism in the genus and to supplement them by others which have been revealed in the course of a revision of the specimens of *Anomala* in the British Museum collection.

The first case of sexual disparity of claw-structure was noticed by Mr. Gahan, who described a species in 1896 under the name of *Anomala egregia* in which the outer claws of the first two pairs of legs are cleft in the female, while in the male they are quite simple; and Herr Kolbe has since described the representative of another group exemplifying a similar interesting phenomenon. In this also the female has the claws of the first two pairs of legs divided, which is the most prevalent condition in the genus, but the male has those of the first pair only divided. Of each of these conditions I shall record additional examples, and also describe the representative of a third condition in which the female has the claw of the front tarsus only divided and the male all the claws undivided.

Belonging to the *egregia* group is *A. kersteni*, Gerst., in which, although it has hitherto been overlooked, the claws are all simple in the male sex, while in the female they are of the typical structure. Of a series of eleven specimens in the British Museum, from Somaliland, Masailand and British East Africa, two are males.

To these two species I propose to add a third belonging to the same group.

A. disparilis, sp. n.

A. Egregiæ et kersteni affinis: elongata, cylindrica, nitida, flavotestacea, tibiis tarsisque rufis; clypeo quadrato fere emarginato, margine valde reflexo, tenuiter punctato; prothorace transverso, polito, minutis sine punctato; elytris fortiter punctato-striatis. Long. 17 mm.

♂. Unguiculis omnibus simplicibus, clypeo testaceo, margine nigro.

♀. Pedum anteriorum et mediorum unguiculis externis fassis, corpore magis robusto, prothorace brevior, clypeo infuscato.

Hab. LAGOS.

This is smaller and more shining than either of the allied species and differs conspicuously by the form of the clypeus, which is straight and angular with the margin sharply reflexed, as in Burmeister's section *Heteroplia*. The prothorax is transverse, but less so in the male than in the female, and is very finely and distantly punctured. The elytra are coarsely punctate-striate with the intervals uniformly finely punctured. The pygidium is coarsely punctured.

As in both the preceding species the males are much less numerous than the females.

The type of the second group, in which the outer claw of the front tarsus only is cleft in the male, is *A. rufa*, Kolbe, described in the recently-published Vol. IV of Deutsche Ost-Afrika. Several other African species hitherto undescribed exhibit the same structure, which it is interesting to notice is that characteristic of the related genus *Popillia*.

A. solida, sp. n.

Ovali-cylindrica, robusta, testacea; capite parvo, clypeo rufo, rotundato, dense punctato; prothorace basi lato, ad apicem regulariter attenuato, lateribus arcuatis, cum scutello vix punctatis; elytris convexis, striato-punctatis; pygidio rugoso; corpore subtus cum pedibus longe fulvo-villosis, tibiis anticis acute bidentatis, posticis tarsisque omnibus rufis, his longis et robustis. Long. 17 mm.

♂. Pedum anteriorum unguiculis inequaliter fassis, tibiarum dentibus inferioribus brevibus et curvatis; clypei margine reflexo.

♀. Pedum anteriorum et mediorum unguiculis equaliter fassis, tibiarum anteriorum dentibus inferioribus longis et rectis tarsisque brevioribus et tenuioribus; clypeo densissime et profunde punctato.

Hab. SOUTH AFRICA, Interior.

The rather narrow head, robust form densely hairy beneath, and strong hairy legs are the most prominent characteristics of this species. The thorax increases regularly in width from apex to base and is not angulated in the middle of the sides. The elytra are rather coarsely, but not deeply, striate-punctate.

A. clypeata, sp. n.

Præcedenti valde affinis sed paulo major; clypeo subtruncato, latitudine maxima ad marginem anteriorem, prothoracis margine laterali in medio subangulato; pygidio grosse punctato. Long. 17—19 mm.

♂. Pedum anteriorum unguiculis inequaliter fassis, tibiarum dentibus inferioribus brevibus et curvatis tarsisque longis et robustis.

♀. Pedum anteriorum et mediorum unguiculis equaliter fassis tibiarum anteriorum dentibus inferioribus longis et rectis tarsisque brevioribus et tenuioribus.

Hab. SOUTH AFRICA, Adelaide.

This is closely allied to *A. solida*, but is distinguished by the shape of the clypeus, which is widest at its extremity.

A. transvalensis, sp. n.

Elongato-ovata, robusta, testacea, tibiis (anterioribus partim) tarsisque rufis; clypeo brevi rotundato-quadrato rugoso, fronte dense punctato; prothorace antrorsum arcuate vix angulariter contracto, cum scutello dense punctatis; elytris profunde lineato-punctatis; pygidio subtiliter striolato-punctato; tibiis anticis acute bidentatis; sterno longe fulvo-hirto. Long. 16—18 mm.

♂. Clypeo utrinque subexcavato, margine valde reflexo, pedum anteriorum unguiculis externis inequaliter fassis, dentibus tibialibus inferioribus brevibus et curvatis.

♀. Paulo major; clypei margine vix reflexo; pedum anteriorum et mediorum unguiculis externis equaliter fassis, tibiaram anteriorum dentibus inferioribus longis et rectis; elytris geminato-lineato-punctatis.

Hab. TRANSVAAL, Pretoria (*Distant*).

The head is relatively broader than in the two preceding species, and the clypeus is shorter.

A. distantii, sp. n.

Præcedenti valde affinis sed minus distincte punctata, prothorace subtilissime punctato, antice fortiter contracto, marginis anterioris emarginatione angustato; elytris parum profunde lineato-punctatis; corpore subtus parce hirto, tibiis posticis tarsisque omnibus rufis. Long. 18 mm.

♂. Pedum anteriorum unguiculis externis inequaliter fassis, tibiaram anteriorum dente inferiore brevi et curvato.

♀. Paulo major, pedum anteriorum et mediorum unguiculis externis equaliter fassis, tibiaram anteriorum dentibus inferioribus longis et rectis.

Hab. TRANSVAAL, Pretoria (*Distant*).

This species exactly resembles the preceding one in size and coloration, but is distinguished by its less distinct puncturation, the narrower emargination of the prothorax, the paler colour of the middle tibiæ and the less abundant pubescence upon the sternum. I have only separated them after a careful comparison of many specimens from various collections.

A. denuda, sp. n.

Cylindrica, vix convexa, testacea, clypeo tibiis tarsisque nigris; tibiis anticis obtuse bidentatis; capite dense punctato, clypeo brevi, rotundato-quadrato; prothorace subplanato, nitido, cum scutello

subtilissime punctulato; elytris subtiliter punctato-striatis, lateribus parallelis medio vix ampliatis; sterno breviter et parce hirto, abdomine nitidissimo, interdum infuscato. Long. 17 mm.

♂. Prothorace paulo elongato; dente tibiali inferiore brevi, tarsorum anteriorum unguiculis externis inequaliter fassis.

♀. Prothorace valde transverso; dente tibiali inferiori paulo longiore, tarsorum anteriorum et mediorum unguiculis externis equaliter fassis.

Hab. OLD CALABAR.

This species strongly resembles the West African *A. disparilis* in size and form, but is easily distinguishable by its black legs and short rounded clypeus. It is more cylindrical and much less hairy beneath than the other species of this group and the puncturation of the elytra is more regular.

The following new species is the representative of the third type of claw-structure already referred to:—

A. calcarata, sp. n.

Breviter ovata, flavo-testacea; capite lævi, vertice bimaculato, clypeo impunctato, margine valde reflexo; prothorace parvo antice fortiter contracto, parum punctato, medio linea impressa; scutello brevi obtuse angulato, laxe punctato, apice profunde impresso; elytris irregulariter punctato-striatis, versus extremitates ampliatis; corpore subtus cum pedibus longe ac dense villosis, tibiis anticis fortiter bidentatis, posticis brevibus triangulariter crassatis, extremitatibus latissimis, calcaribus duobus longis singulo armatis; tarsis elongatis. Long. 16 mm.

♂. Corpore brevi; clypeo lato; unguiculis omnibus simplicibus.

♀. Corpore magis elongato; clypeo minus lato; pedum anteriorum unguiculis externis apice emarginatis.

Hab. SOUTH AFRICA, Cape of Good Hope (*Reiche*).

This species occupies an isolated position in the genus by its many structural peculiarities. It is shorter and more ovate than any other testaceous species known to me. The head and clypeus have only a few scattered punctures. The thorax is broad behind and strongly lobed in the middle. The elytra are coarsely punctured, the punctures, which are sometimes confluent, being chiefly arranged in irregularly placed striæ. The hind tibiæ are short, very slender at the base and regularly

thicken to the extremity, where they are very wide and furnished with two strong spurs, the upper one very long.

The very distinctive structure of the legs of this insect will probably be found to require the ultimate formation of a new genus for it, but in the present comprehensive state of the genus *Anomala* this does not appear advisable.

Several cases of difference in coloration between the sexes in species of *Anomala* were mentioned by Burmeister, and M. Fairmaire has recently called attention to two other instances; and although one or two of these cases must be regarded as doubtful, it will probably be found that this form of sexual dimorphism is by no means rare in the genus.

The species contained in Burmeister's *Handbuch* of which the sexes are stated to show differences of coloration are the two common species *A. lucicola*, Fabr., and *A. vidua*, Newm., from North and Central America respectively, the S. European *A. aurata*, Fabr., *A. trivittata*, Perty, and *A. irrorella*, Cast., from Java. Of these, however, the last must be excepted, as M. Lansberge has pointed out that the form regarded by Burmeister as the male is another species, to which he has given the name of *A. burmeisteri*.

The same author's statement that the colour differences of *A. vidua* are sexual has been controverted by Mr. H. W. Bates, who has stated that two of the three varieties of the species are represented by both sexes in the Central American collection of Messrs. Godman and Salvin. I have carefully examined the specimens in this collection now in the British Museum, and find that every individual of the light form is a female, and those of the dark forms males, with a single exception. The exceptional case of the second form was probably in Mr. Bates' own collection, or he may possibly have been mistaken, upon a cursory examination, as to the sex; but notwithstanding its liability to exception, there is amply sufficient evidence that Burmeister was justified in pronouncing this a case of sexual dimorphism. Of nearly 70 specimens of the species which I have minutely examined, the single female mentioned above is the only exception to the rule that the form with pale elytra is the female and those with black elytra are males.

The closely related insect described by Bates under the name of *A. nutans* must be regarded as a partially dimorphic species, the entirely black variety consisting of both sexes apparently in about equal numbers, while the specimens with red elytra are females and those in which they are more or less bordered with black are males. This species is very much more variable than the preceding one, the varieties being much less constant, and as it is in other respects less specialised than *A. vidua* it may possibly be regarded as representing the ancestral form of the latter in which the separation of the sexes has not been entirely completed.

Another example is *A. oblivia*, Horn, a North American species, which, as is shown by his description of the claws, Dr. Horn has described from the male sex only. Specimens of the female in the British Museum are entirely testaceous in colour, the metallic lustre only being rather more apparent on the thorax, which is also somewhat more elongate. The outer anterior claw, as is usual in this sex, is approximately equally cleft, and the lower tibial tooth long and curved.

The fourth New World example is the common North American *A. lucicola*, Fabr., in which the female is either wholly testaceous, or testaceous with a very narrow black external margin to the elytra, and the male either entirely black or testaceous with the thorax wholly or partially black and a black suture and margin to the elytra.

Of the next species the two forms have been described by M. Fairmaire under the names of *Popillia exarata* and *cinnabarina*, and although I have only been able to examine three specimens, the characters mentioned by the author leave little doubt that the forms are sexual and not merely varieties. M. Fairmaire's *P. exarata* is an insect of a deep bluish or greenish black colour of which I have seen two individuals, both of them males; and the description given of the front tarsus of which the "fourth" joint (obviously intended for the fifth) is inflated, and the enlarged outer claw, clearly shows that M. Fairmaire's specimens are also of that sex. Subsequently an insect similarly coloured but with its elytra of a bright brick-red was described from the same locality (Yunnan, in S.W. China), and this from a specimen before me proves to be the female of *exarata*. The slightly larger size and relatively shorter elytra (due to a lateral expansion peculiar to the

females of these insects) mentioned by the describer confirm my view.

The comparison of this species with Redtenbacher's *Popillia sulcata* is unfortunate, as that insect is a true *Popillia*, whereas the present one, as indicated by the naked pygidium and the claws of the middle feet divided in both sexes, has not any affinity with that genus. It belongs to the group of *Anomalas* represented by *A. iris*, Candèze, and is intermediate between that species and *A. lateralis*, Hope. It is also interesting as a link between the Asiatic and American *Anomalas*, showing an evident relationship both in structure and appearance, as well as in the fact of dimorphism, with the Mexican insects just described.

This insect has been made by Dr. Kraatz the type of a new genus, under the name of *Ischnopopillia exarata*, upon the strength of characters which differentiate it from the genus *Popillia*, but in no way distinguish it from *Anomala*. *Popillia rugicollis*, Newm., also referred to *Ischnopopillia* by Kraatz, is the insect, *Anomala lateralis*, Hope, mentioned above.

The name *exarata* is pre-occupied in the genus *Anomala*, and this species must accordingly be called *A. cinnabarina*. This name has been more recently given by M. Fairmaire to another insect which must therefore be re-named. I propose to call it *Anomala fairmairei*.

In 1891 M. Fairmaire announced that *Anomala rufozonula* and *A. rufopartita*, which had been described on two different occasions by himself, were the male and female of the same species. The British Museum contains a long series of this insect, showing an almost uninterrupted gradation from the form *rufozonula*, in which the insect is wholly black with the exception of an orange band across the elytra, to one in which the elytra and prothorax are wholly orange except a very narrow black sutural line and patch in the centre of the thorax, *rufopartita* being intermediate between these forms. Both sexes appear equally variable, the dark *rufozonula* being represented in the national collection by females as well as males, whilst the extreme light form referred to, and one of the intermediate varieties connecting it with *rufopartita* (considered by M. Fairmaire to be the female) are males. The only colour difference exhibited by all our specimens is in the abdomen, which in all the males is entirely black, whilst in none of the females has the orange quite disappeared, but even

this in such an extremely variable species cannot be stated as absolutely invariable.

The other species of Fairmaire's referred to above is *Anomala 6-oculata* from Tibet, in which the elytra are pale yellow in the female and brown in the male; and this exemplifies the general rule for those species which exhibit colour differences, the female being characterised by a less development of the colouring matter, which in the male takes the form of darker markings of greater or less extent, or when at its maximum may suffuse the entire surface with black.

Closely related to *A. 6-oculata*, and showing the same sexual difference, is *A. straminea*, Semenow, an insect from North China, which in the female is uniformly straw-coloured, while in the male the elytra are more or less deeply fuscous and the thorax and head marked with patches of the same colour. In his description of this species, the author speaks of it as "maculis nonnunquam evanescentibus," showing that he had the female, but regarded it as merely a variety.

In *A. mutans*, Blanch., on the contrary, the male form has been described as the variety and the female, which is pale, with the exception of a dark-red head, scutellum and suture, as the typical form. The male of this species (the author's "var. tota nigro-picea") is a shining black over the whole upper surface with the exception of a narrow margin to the thorax and sometimes a fine median line.

The following new species is remarkable as presenting, as well as a similar disparity in coloration, a peculiar difference in the sculpture of the upper surface, the elytra of the male being shining while those of the female are very densely rugose and opaque, thus recalling a somewhat similar sexual difference which occurs in certain of the Water Beetles.

A. rugosa, sp. n.

Breviter ovata, rufo-testacea; capite rufo-fusco, dense punctato, clypeo semicirculariter arcuato, margine paulo reflexo; prothorace brevi, convexo, nitido, punctato, lateribus valde arcuatis, angulis posticis rotundatis, disco bimaculato, maculis triangularibus, basibus in disci medio approximatis, nonnunquam confluentibus; scutello rufo vel fusco, grosse punctato; subtus cum pedibus rufis, tarsorum anteriorum et mediorum unguiculis fassis. Long. 14 mm.

♂. Elytris nigris, interdum maculis parvis humeralibus, lateralibus et apicalibus punctato-striatis, interstitiis subtiliter punctatis; tibiis anticis tridentatis, tarsorum anticorum unguiculi divisione inferiore majore.

♀. Elytris rufo-testaceis, obsolete striatis, densissime rugosis, marginibus vittaque obliqua ab humero fere ad apicem decurrente nigris; tibiis anticis bidentatis, tarsorum anticorum unguiculi divisione superiore majore.

Hab. N. INDIA: Punjab, Himalayas.

This species is similar in form and marking to *A. varicolor*, Gyllenh., but is very distinct by the sexual differences referred to. The female bore the unpublished name of *A. rugosa* in Reiche's collection. Burmeister has very briefly described a species, *A. ruficapilla*, from the same locality, which resembles the female of *A. rugosa*, but the description applies, according to the author, to both sexes. In his species, moreover, the front tibia is three-toothed, and the sculpture of the elytra differs from that of *A. rugosa*.

Another new species differs from those preceding in the fact that the sexes exhibit an entire difference in the colour itself and not merely in its distribution. In the male the colour is a rich deep purple and in the female a rather dark metallic green. Even in immature specimens in which the colour is undeveloped the sexes may be readily distinguished by a slight reddish or greenish lustre.

A. imperialis, sp. n.

Oblongo-ovata, subdepressa, æneo-testacea; capite punctato-rugoso, clypeo semicirculariter arcuato; prothorace pallide marginato, crebre punctato, profunde longitudinaliter sulcato, lateribus angulato arcuato, angulis posticis obtusis; scutello testaceo, punctato; elytris costatis, subtiliter punctatis; pedibus longissimis. Long. 16 mm.

♂. Capite, prothoracis disco elytrisque purpureis; pygidio testaceo, tumido, strigato-punctato, apice obtuso.

♀. Fronte, prothoracis disco elytris pygidioque viridibus; prothorace latiore; pygidio subplano, subtiliter rugoso, acuminato.

Hab. NORTH CHINA (*Fortune*).

This species is allied to *A. anax*, Wied., which it resembles in size, form and sculpture, but it is rather more depressed and less densely punctured. The furrow on the thorax is broader and the elytral costæ rounded. The

male appears to be rather more abundant than the female, and is quite unmistakable from its deep purple hue.

Two peculiar insects were described by Blanchard under the generic name *Adoretosoma* and placed after the genus *Adoretus*, but these appear in the Munich Catalogue in the genus *Anomala*. These are *A. elegans* and *A. fulviventre*, both Indian species. At least three closely related species have been described from China by M. Fairmaire, who has assigned them to the genus *Phyllopertha* under the names of *chromatica*, *tenuelimbata* and *virgulata*. It is possible that others of the new species placed in the same genus by M. Fairmaire may be congeneric, but in the absence of structural characters this cannot be determined from the descriptions. *P. tenuelimbata* and a closely related new species afford further examples of sexual dimorphism, and it seems likely that all the species mentioned above have been described from representatives of one sex only, but with the exception of these two I have not been able to find both sexes of any of them.

There can be no doubt as to the advisability of restoring this group to generic rank, and the addition of the sexual characters to those given by Blanchard will render the genus very easily recognisable.

Adoretosoma, Blanch., Cat. Col. Ent. Paris, 1860, p. 234.

Unguiculis gracilibus et longissimis, pedum anteriorum mediorumque externis fassis, ♀ anteriorum regulariter curvatis, apice equaliter divis; ♂ pedum anteriorum tarsis incrassatis, unguiculo externo quam interno multo longiore, recto, post medium spino minutissimo armato, tibiis anterioribus brevioribus dentibusque minoribus valde approximatis.

Phyllopertha tenuelimbata, Fairm., referred to above was described in the Ann. Soc. Ent. Franc. for 1889, p. 24; and in the Comptes Rendus, Soc. Ent. Belg., 1891, p. cciii, M. Fairmaire described another new species under the same name. From this our species must be carefully distinguished. As the first species will become *Adoretosoma tenuelimbatum*, the second may perhaps be allowed to retain the name inadvertently given to it. M. Fairmaire's description of the former insect applies to the female only, which is a pale yellow insect with a very narrow green sutural line and a large green spot in the middle of the thorax. The male has the vertex of the head, the disc of

the thorax, the scutellum and the elytra, with the exception of a pale longitudinal vitta upon each bordering the suture and usually extending to half the breadth, of a deep green. The suture is narrowly green. The thorax is narrower than in the female and is rather more sharply angulated in the middle of the sides.

The following is a closely related species.

Adoratosoma metallicum, sp. n.

Cylindricum, rufotestaceum, nitidissimum, pedum intermediorum et posticorum tarsis tibiaramque extremitatibus nigris; capite rugoso, vertice nitido vix punctato; prothorace distincte marginato vix punctato, lateribus angulatis, angulis anticis acutis, posticis rectis; elytris grosse lineato-punctatis.

♂. Capitis vertice, prothoracis medio elytrisque viridibus vel viridicæruleis. Long. 13 mm.

♀. Major, capite prothoraceque rubris, elytris viridibus vel viridicæruleis. Long. 15 mm.

Hab. NORTH CHINA, Shanghai.

This is a larger species than *A. tenuelimbatum* and has not the deeply striated elytra of that and the two original species of the genus, approaching in this respect and in colour *A. chromatium*. The male is similarly coloured to that of *A. tenuelimbatum*, but the dark colour extends over the whole of the elytra, and the patch on the thorax reaches the front and hind margins. In the female the elytra are also wholly green or blue, but the head and thorax are a metallic red. The thoracic mark is sometimes represented by a pair of faint dark marks in the middle of the base of the thorax.

In the neighbouring genus *Popillia* sexual dimorphism appears again. Fabricius described an insect belonging to this genus of which the upper surface is black under the name of *Cetonia rufipes*, and two other forms, red and green respectively, were described by Newman, who, however, suggested the possibility of all three being varieties of a single species. Attention to the form of the abdomen and legs shows at once that the metallic green insects (*Popillia æneas* of Newman) are females and the black individuals males, those with the elytra more or less red being also males and probably only immature. Burmeister associated the three forms, but announced that the black and green colours were most

often found in the females and the red in the males. He may have been misled by the examination of an aberrant female, for one of many which I have examined is gynandromorphous, showing the black coloration proper to the males; or, as he nowhere mentions the principal sexual characters of the genus, it is possible that he was entirely mistaken as to the sexes of his specimens. These characters have not been fully pointed out by subsequent monographers, so that it may be well to describe them here.

The tibiæ, tarsi and claws of the male are all considerably stouter than in the female, and the teeth on the front tibiæ are short, sharp and conical, whereas in the female the anterior one is produced and convex. The outer claw of the anterior tarsus in the male forms a flattened plate and has a sharp slender tooth near its extremity; that of the middle tarsus is very long and undivided. In the other sex both are simply bifid. The antennal club is perceptibly longer in the male and the pygidium is visible from beneath. In the female the pygidium is only visible from above, the junction with the last ventral segment being at the extremity of the body and not ventral.

Another and closely related example in this genus is *Popillia flavotrabeata*, Thoms., of which only the female appears to have been as yet described. This is an elongate golden- or bronzy-green insect with yellow margins to the thorax and an oblique band of the same colour on each elytron, which however is liable to disappear. The male exactly corresponds to that of *P. rufipes*, except that the thorax retains the coloration of the female, the elytra in fully mature specimens being shining black. The legs in both species are paler and non-metallic in the male. It is remarkable that of this species also a single female specimen in the British Museum has the male coloration, although a trace still remains of the pale elytral streak peculiar to its own sex.

The female of this species is also *P. lacertosa* of Candèze. Herr Kolbe in his monograph of the African species of *Popillia* suggests the identity of this with Thomson's species, and of this I have no doubt.

It will be seen that the sexual differences in the structure of the claws are confined to the African species of the cylindrical testaceous group of *Anomalus*, whereas colour dimorphism occurs in species from all parts of the world representing widely separated sections of the genus. In every case of the latter type the distinction consists not in

any fundamental difference but in the degree of development of the colouring matter, the male, with the exception of the aberrant individuals referred to of the Mexican species, exhibiting a greater exuberance than the female, or the superposition of a darker hue. *Anomala imperialis*, described in this paper, is an apparent exception to this rule, the colours of the two sexes appearing to be unrelated. But experiment shows that the metallic purple colour characteristic of the male of this species is transformed by exposure to sunlight into a green like that of the female, so that here also the male form is obtained by an addition to that characteristic of the female.

From this rule it results that, given a sufficiently wide range of variation, the line of separation will be liable to obliteration, and it may be found that certain individuals of some of the species do not correspond with the sexual characters given; but this will not interfere with the general fact, for in every case mentioned, (except that of *Anomala cinnabarina*, where the original descriptions appear to warrant my conclusion,) the number of specimens examined seems sufficient to establish the general rule; and several species which in all probability belong to this category have been omitted because the number of specimens I have been able to examine is insufficient to be conclusive.

It is important to notice, that the cases of aberration to which I have referred are without exception of the female sex, thus associating them with those cases familiar to us amongst higher animals of the phenomenon of Gynandromorphism, which appears to be of occasional occurrence wherever secondary sexual characters are found.

Table of species exhibiting Sexual Dimorphism.

The Sexes differing in Claw Structure.

<i>Anomala egregia</i> , Gahan.	. . .	Somaliland.
<i>A. disparilis</i> , sp. n.	. . .	Gold Coast.
<i>A. kersteni</i> , Gerst.	. . .	Zanzibar.
<i>A. rufa</i> , Kolbe	. . .	Germ. E. Africa.
<i>A. solida</i> , sp. n.	. . .	S. Africa.
<i>A. clypeatu</i> , sp. n.	. . .	S. Africa.
<i>A. transvalensis</i> , sp. n.	. . .	Transvaal.
<i>A. distanti</i> , sp. n.	. . .	Transvaal.
<i>A. denuda</i> , sp. n.	. . .	Old Calabar.
<i>A. calcarata</i> , sp. n.	. . .	S. Africa.

The Sexes differing in Coloration.

<i>Anomala 6-oculata</i> , Fairm.	. . . . .	Tibet.
<i>A. straminea</i> , Sem.	. . . . .	N. China.
<i>A. rugosa</i> , sp. n.	. . . . .	Nepal.
<i>A. mutans</i> , Blanch.	. . . . .	Sierra Leone.
<i>A. 3-vittata</i> , Perty.	. . . . .	Java.
<i>A. aurata</i> , Fabr.	. . . . .	E. Europe.
<i>A. imperialis</i> , sp. n.	. . . . .	N. China.
<i>A. cinnabarina</i> , sp. n.	. . . . .	S.W. China.
<i>A. vidua</i> , Newm.	. . . . .	Mexico.
<i>A. nutans</i> , Bates	. . . . .	Mexico.
<i>A. oblivia</i> , Horn.	. . . . .	U. States.
<i>A. lucicola</i> , Fabr.	. . . . .	U. States.
<i>Adoretosoma tenuelimbatum</i> , Fairm.	. . . . .	N. China.
<i>A. metallicum</i> , sp. n.	. . . . .	N. China.
<i>Popillia rufipes</i> , Fabr.	. . . . .	W. Africa.
<i>P. flavotrabeata</i> , Thoms.	. . . . .	W. Africa.